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DICKY : A New Learning Model Which Is A Combination Of Artificial Intelligence And ICT In Vocational Education

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ABSTRACT

This research is how to development of learning models to be able to answer the challenges of this Industrial Revolution 4.0 era. The problem identified was the lack of learning outcomes, especially subjects oriented to software engineering for information systems students in particular and other computer science seen in the phenomenon of the inability of students to produce intelligent systems. From a series of validity, practicality, and effectiveness test results, using content validity with Aiken'V and construct validity with CFA (Confirmatory Factor Analysis) states that the model resulting from this study is stated, valid, practical and effective. This study also produced a new learning model with 5 syntaxes, namely (1) Define Problem and Design Project Plan, (2) Integrated of Support System, (3) Create a Project, (4) Keep control and Project Monitoring, (4) Yield and Assessment of Project. And based on the test of the validity of the syntax of this model stated goodness-of-fit or valid. The results of the study were obtained from 3 learning aspects for affective elements; there are 7 aspects of the affective domain that have better grades than the control class, and from the psychomotor aspect both in the control class with an average value of 80.08 while in the experimental class the average psychomotor value is 85.78. From the cognitive aspect, students said that it was easier to get references and design an intelligent system.

Keywords:

DICKY’s Learning Model
Artificial Intelligence
Intelligent Tutoring System
Project Based Learning
Learning Management System

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1. INTRODUCTION

The world is currently in an era of technological disruption, and digital literacy called the Industrial Revolution 4.0. One factor students must have is critical thinking [1]. The hallmark of this era is the extensive and structured use of information and communication technology (ICT) in aspects of human life such as social, economic and educational aspects. The process of digitization, human and computer interaction, automatic exchange of data and communication, the distortion of various human activities, and the use of information technology tools in the field of science and technology (science and technology) are characteristic in this era. In this condition, the country needs to issue strategic policies in dealing with it, including Indonesia. Based on the survey, Indonesia faces a digital era with more than 43 million Facebook accounts and 19 million Twitter accounts [2].

The current government through the Ministry of Technology Research and Higher Education appealed to the leaders of higher education, especially in vocational education and training to innovate, including curriculum reconstruction. Two things were targeted in this reconstruction process including (a) giving students broader skills or competencies such as coding, big data analysis, and artificial intelligence, (b) changing the learning process face to face into blended learning and fully online learning as a new format of the learning process. Besides the learning process, there are challenges and opportunities from the development of vocational education in Indonesia, especially in the field of information and technology. There are two technical challenges, namely: (a) technological development and exponential data such as technical skills, analytical skills, efficiency in adopting data, coding skills, and the ability to understand information technology, and (b) fostering collaborative work such as being able to work in teams, having virtual communication skills, have skills in the field of learning media, and the ability to have cooperative skills[3].

The substance of 21st-century learning[4], three skills become the target of learning content, namely: (a) skills and innovation learning so that students have critical thinking skills, communication skills, collaborative abilities, and have creativity, (b) digital literacy skills which include literacy information, media, information and communication technology, and (c) career and life skills which include flexibility, initiative, productivity, and adaptability. The Industrial Revolution 4.0 also formed a chronosystem which is seen in Figure 1.1 below.

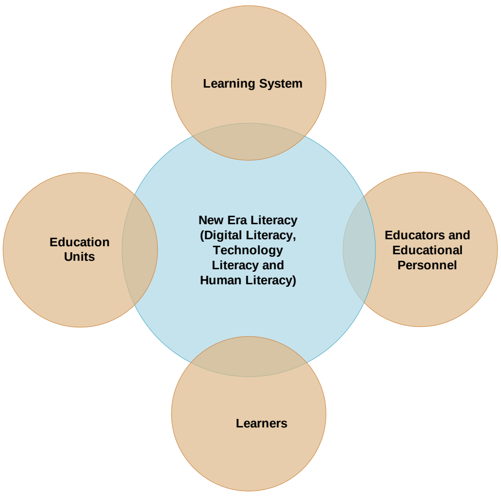

Figure 1. Vocational Education Chronosystem in the Era of the Industrial Revolution 4.0 [5]

Chronosystem must be able to integrate several elements, both physical, digital and biological. These elements can be used as a part to strengthen the process of digital literacy, social literacy, and technological literacy. These efforts were made to provide added value and competitiveness for vocational education graduates in the industrial revolution 4.0. From Figure 1. above, it shows that there is a relationship or iteration of elements of the education unit, the learning system, educators and education personnel and students towards the new era of literacy, namely digital literacy.

The learning outcomes of a learning course become a benchmark of success of the lecturer in delivering teaching material, of course. In this study, referring to the phenomena and survey data collected through a digital-based questionnaire using google. Form related to learning outcomes, especially those obtained from alumni and students majoring in computer science and information systems who are or have completed their final project such as a thesis. Of the 35 respondents gathered 32 respondents graduated from S1 in Information Systems and 3 respondents from S1 in Computer Science. Based on these data, from 35 respondents stated that on average 25 respondents received final grade A grades in final-oriented courses such as: (a) Decision support systems, (b) Cryptography, (c) Expert Systems, (d) Artificial Neural Networks, (e)

Modeling and simulation, and (f) Data Mining and warehousing. But the unique thing from the data is that the grade A value is not directly proportional to the ability to produce research in that field. From these data, 90% of respondents could not create analysis in the form of engineering software from the area and in the end, but the program or software as final testing material to other parties.

Based on the preliminary survey data, the average student who gets a good grade has the ability at level-2 (understanding) based on the bloom's taxonomy. This is reflected due to the inability of students to analyze problems, combine related elements, encode, and develop software. Whereas it is expected that learning outcomes will be at least level 4 (analysis) up to level 6 (creations) relevant to the Indonesian National Qualification Framework which places graduates of Grade 6 graduates (an analyst). There are 2 factors that cause the ability of students at this level based on the initial identification of the problem, including (1) the factor of the substance of teaching material. The material taught by lecturers is oriented in understanding algorithms, methods or techniques, so students are only able to understand the use of methods, algorithms or techniques for textual problem solving and (2) the learning model adopted by the lecturer. The model adopted is still TCL (Teacher Center Learning) with the lecture method resulting in students only able to calculate, explain, model, and describe the methods, algorithms or techniques adopted in the course but cannot design, combine, create and develop material that is taught into the development of a software or application.

From the survey results, it turns out that the understanding of lecturers is more in understanding the algorithms, methods or techniques of these fields of study textually but is unable to translate into a coding code or source code. Based on the above conditions, aspects of competency achieved by students at this time are only limited to aspects of knowledge such as mathematical competencies and general skills aspects such as competencies from processing data information. While other aspects of skills such as competencies in software engineering and competencies in smart systems are not achieved [6].

Based on the conditions above, innovation or efforts to synchronize the understanding of algorithms and translate them in source code are needed to improve student competency and learning ability. Some research is done by using several concepts and approaches in learning algorithms such as active learning. Based on this active learning approach, the results of learning algorithms by adopting mathematical concepts and calculus are better than other approaches[7]. In addition, in the context of how to understand the basics of computer programming can be done by several methods, including recitation methods. This recitation method is a method that makes the learner as a facilitator and gives the task to students to learn something independently and report how the results are [8]. In addition, there have been several efforts that have been made, including how to build a learning management system in learning the structure of algorithms and programming [9].

One innovation in improving the results of the learning process in the application of artificial intelligence. Utilization of artificial intelligence is expected to be able to convey information and be a solution for the application of cybersecurity. In addition, by applying artificial intelligence will provide added value from several aspects of learning, including the tutoring process, independent learning, testing, and computerized testing [10]. The problems that arise today in the midst of society and the world of education are technological disturbances in education. The problem of technological disturbances is developing so that there need to be strategies and innovative efforts that are able to answer these challenges. One of the efforts made in adopting technology and artificial intelligence in education [11].

In artificial intelligence, there are several interesting fields of study, including expert systems, decision support systems, robotics, computer vision, and intelligent tutoring systems. To develop a comprehensive framework for 21st-century learning requires more than identifying specific skills, content knowledge, expertise and skills and this is where the intelligent tutoring system can be applied. An innovative support system must be created to help students master the multi-dimensional capabilities that will be needed in the 21st century. Related to this is, of course, the 21st century learning with the development of constructivism learning theory towards connectivity, information and communication technology (ICT) to become a very pioneer or element important. In this research, based on these important instruments beforehand, there are some things that will be tried to be facilitated by the concept of the intelligent tutoring system.

During this time the use of information and communication technology (ICT) in the field of learning focuses on how to convey information and interactions between students and teachers such as the design of LMS (Learning Management System). The existing LMS does not apply artificial intelligence in it to optimize learning outcomes. In this study will be developed in addition to LMS as a support system to convey information, but there is also a computer-based test and machine learning in it. Computer-Based Tests are constructed to assist teachers in conducting assessments, and machine learning are used to assist in tutoring algorithm learning [12],[13].

Whereas in the current learning Intelligent Tutoring System and artificial intelligence are very much needed in learning in improving learning outcomes in this digitalization era [14]. Intelligent Tutoring System can be interpreted as a computer application that can mimic or duplicate what humans do. In the intelligent tutoring system, there are 5 elements or components including the expert model, student model, instructor model and user interface [11]. Intelligent Tutoring System can be used for various activities, especially in learning. Among them are Photoshop learning [15]. Besides that, there is also learning Cryptography Data Encryption Standard (DES) with the concept of an intelligent tutoring system, and the results of this learning are good[16].

Project-Based Learning Model is a construct based learning model. While based on current conditions, the theory of learning adopted is constructivism. The weakness that exists in project-based learning so far is that most students carry out instructions based on the project plan[17].In an effort to improve the quality of learning, a lot of research and research that tries to adopt technology in this constructed model, as well as a combination of project-based learning with social media. From this research, it can be seen that there is an increase in learning outcomes from those only implementing project-based learning adopting technologies such as social media [18], [19].

From the cognitive aspect it turns out that project-based learning that adopts technology in learning, it turns out that the value of the experimental group and the control group that adopts CAL (Computer Assisted Learning) [20] or computer assisted test are better than those that do not implement[20],[21]. For the learning model Project Based Learning has 6 syntaxes, namely: (1) Start With the Essential Question, (2) Design Plan For Projects, (3) Create a schedule, (4) Monitoring, (5) Assist of Outcome and (6)) Evaluate the Experience. From these 6 syntaxes then [22] developed from the Project-Based Learning model to Rs-PjBL (Resource Sharing-Project Based Learning) where this model with 7 syntaxes are (1) Analysis of Need Assessment of Teacher and Learner, (2) Design and Development of Computer Hardware, (3) Design and Development of Software, (4) Development of System, (5) Project Assistance and Training, (6) Dissemination project, and (7) Assessment of Outcome. In the concept of Resource Sharing-Project Based Learning still adopts LMS (Learning Management System) in learning. Project-Based Learning learning models are andragogy-based learning developed in the 2005-2013 time span. In 2013 since the start of the industrial revolution era 4.0, the approach used in the concept of learning was Heutagogy. The approach adopted in learning the industrial revolution 4.0 there are several concepts including online learning, collaboration, creativity, the theory of connectivity, and the heutagogy approach [23].

Specifically, in this study also for the Project-Based Learning model based on Intelligent Tutoring System can be applied in helping students to understand the decision support system courses as a sample of research objects. It was chosen to see the extent to which this model can contribute well in improving the learning outcomes of decision support systems courses because artificial intelligence is effective in this learning (Pek & Poh, 2005). It is hoped that this new model can be a solution to the problems that occur in particular to face the era of digital literacy and the industrial revolution 4.0 as it is happening today.

2. RESEARCH METHOD

In a study, one of the most important things is the research method. Based on the type in general, research can be classified into several, namely quantitative research, qualitative research and development research. The method used in this research is the research and development (R&D) model Borg and Gall and continued experimentation. The development model in this study through the stages starting from the conceptual model phase, theoretical models, then hypothetical models, and final models. The conceptual model can be interpreted as an analytical model, which mentions the components of the product, analyzes the components in detail, and shows the relationships between the components to be developed. Then the model that describes a framework based on relevant theories and supported by empirical data can be called a theoretical model. In addition there is a hypothetical model. This hypothetical model can be interpreted as a model sourced from expert and practitioner input through focus group discussions (FGDs). The final model is a model that has been empirically tested.

The development of the model in this study is called the Project Based Learning Model into the DICKY Learning Model based on the Intelligent Tutoring System. The development method in this research refers to the R&D stage model which Borg and Gall Model. In this research, the main objective is the development of a learning model that synergizes with artificial intelligence. This research is basically development research followed by experiment. Following are the development procedures and steps for developing a DICKY Learning Model based on the Intelligent Tutoring System. Puslitjaknov (2008: 11), the development research procedure above can be simplified by 5 main steps, namely:

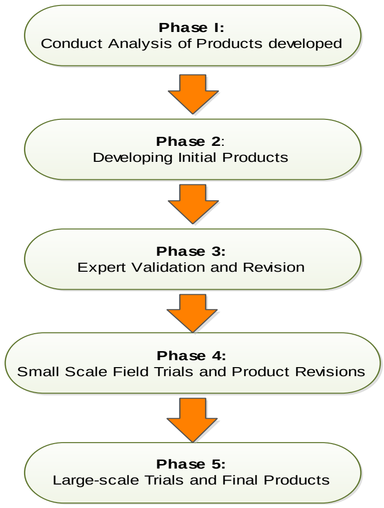

Figure 1. Phase of Developing Learning Moedel

The stages of the procedure for developing a DICKY Learning Model based on the Intelligent Tutoring System can be explained in the table below:

Table 1. Acitivities of Developing DICKY's Learning Model

Phases	Activities
Conduct Analysis of Products developed	In Phase I (Analysis**)** in this Development Procedure, there are several things done, including problem analysis, needs analysis (both in terms of learning and software design in supporting the learning process). At this stage, researchers analyze learning needs by gathering information that will be used as learning material. This relates to the Requirement Analysis and Planning system that will be designed. In this stage it is a phase to collect initial research data both data about research subjects (students, parents and lecturers), research objects (Decision Support System), learning tools to be adopted, features (Specifications) both Software and Hardware will be used in learning tools in the DICKY Learning Model based on the Intelligent Tutoring System. In addition, several aspects that need to be done in designing products in this study are. a) Procedures that students and lecturers must use in using the system, b) determine learning materials used as parameters to support learning, especially in Decision Support System techniques, c) conduct Focus Group Discussions. Also important at this stage is analyzing the need for instructional design.
Developing Initial Products	In Phase II, the development of learning is affiliated with the system design on the development of learning devices. The researcher makes the design of learning and also from the perspective of the system, the researcher designs the Database, Management Information System, Learning Management System, Computer Based Test (CBT) and software testing to improve learning outcomes. At this stage also, the researcher builds a new learning model by adopting Artificial Intelligence and Simulator and CAI (Computer Assisted Instruction) as a model to be developed. In addition, at this stage, the researcher also builds a system based on the previous stage.
Expert Validation and Revision	At this stage, namely the validation by experts of the product being developed. The details of the activities carried out in stages are: a. FGD (Focus Group Discussion): is a focus group discussion where scientific discussion is used for several things, namely: 1. digging in-depth information about the initial product developed in the form of the DICKY Model and learning tools, 2. developing research hypotheses, 3. collecting data needed to develop products in the form of constructive suggestions and criticisms. The procedure in carrying out this activity is by presenting a number of experts related to the product developed by experts in the areas of Learning Models, Curriculum, Software Engineering, Decision Support Systems, and in terms of language. The results of this activity are inputs that can be used as a reference in improving products that are developed both learning models and learning tools. (b). Expert validation is a process used to validate the products produced both the learning model and learning tools. Validation is done from the perspective of content validity. This process also involves the distribution of numbers that have been provided to research objects to validate some aspects that are needed both in terms of learning models and learning tools.
Small Scale Field Trials and Product Revisions	At this stage, the initial testing and integration are done. The activity carried out is small-scale initial testing involving research subjects and integrating learning products at www.learning mcda.com. In addition, at this stage, the validity, practicality and effectiveness of the DICKY Learning Model based on the Intelligent Tutoring System with a statistical approach.
Large-scale Trials and Final Products	There are several things done at this stage, namely: the final evaluation after a large-scale trial and the dissemination phase. At this stage, the final evaluation is carried out by conducting a Focus Group Discussion before the product produced will be disseminated. The product that has been evaluated is the result of research and development of the DICKY Learning Model based on the Intelligent Tutoring System. This result is valid, practical and effective and ready to be disseminated. The implementation phase in the learning model synergizes with the implementation and maintenance stages of the product in the development of learning tools or products. At this stage, the activity carried out was to implement the DICKY Learning Model based on the Intelligent Tutoring System at some time before the second validation was conducted by the Validator in the FGD.

3. RESULTS AND ANALYSIS

3.1. Syntax

Based on the rationale and theoretical foundation that supports the DICKY model based on the Intelligent Tutoring System, a new learning model is developed that integrates Project-Based Learning and Intelligent Tutoring System. The basis for thinking DICKY models based on Intelligent Tutoring System is referring to several factors, namely: (1) Bloom's Taxonomy, (2) Previous Learning Models (Project-Based Learning, Resource Project-Based Learning and Blended Learning, (3) Interactivity, and (4) Learning style and (5) Development of ICT on Education[24].

Some indicators of cognitive learning are: emphasizing the ways a person uses his mind to learn, remember, and use the knowledge that has been obtained and stored in his mind effectively. In essence, verbal or visual learning that underlies observations that involve all the senses saves a longer impression and creates a sensation that leaves an imprint on students. In constructivism learning where the indicators are the reconstruction of knowledge, the discovery process, student-centred, the existence of social interaction and reflection. Social media attitude is one of important thing in vocational education student[25]. Indicators for interactivity are interactions between students and other students, and students with technology. From these weaknesses added to the strengths of the Intelligent Tutoring System, it is necessary to have a combination of 2 aspects, namely the learning model itself and the learning device aspect. From the existing models that start with the PjBL (Project Based Learning) model only focusing on project construction without involving information technology, it is necessary to develop. From the syntax (1), the syntax (2) and the syntax (3) on the PjBL (Project Based Learning) model can be accommodated with the new syntax in the DICKY-PJBL Learning model, namely: Define a Problem and Design a Plan Project.

Then from the syntax in Rs-PjBL (Resource Sharing-Project Based Learning) both syntax (2), syntax (3), syntax (4), and syntax (5) can be integrated with new syntax in the DICKY learning model based on Intelligent Tutoring System, namely syntax (3) Creating Project. For syntax (5) in the Rs-PjBL (Resource Sharing-Project Based Learning) model and syntax (4) in the PjBL (Project Based Learning) model are accommodated with syntax (4) in the DICKY-PJBL learning model based on the Intelligent Tutoring System that is Keep Control of Project. And the syntax (5) and syntax (6) in the PjBL (Project Based Learning) model and the syntax (7) in the Rs-PjBL (Resource Sharing-Project Based Learning) model are accommodated with a new syntax in the Intelligent-based PICK learning model based on Intelligent The Tutoring System is Yield and Assessment of Project. What distinguishes the syntax of the new model with the old model is the syntax (2) integrated of support system. In this syntax is the adoption of artificial intelligence and Intelligent Tutoring System in an effort to improve learning outcomes [26], [11], [19]. With a combination of these two elements, a new learning model called the DICKY-PJBL Learning Model based on the Intelligent Tutoring System is created. The choice of the DICKY-PJBL name, in this case, is identical to the syntax of this learning model, while the syntax is (1) Define the problem and Design a Project Plan, (2) Integrated Support System, (3) Creating Project, (4) Keep Control and Monitoring Project and (5) Yield and Assessment of Project.

The following is a comparison or comparative study between the syntax of Project Based Learning, Blended Learning and the syntax of the DICKY Model based on the Intelligent Tutoring System as shown in the table below:

Table 2. Comparative Study of Model Syntax

Project-Based Learning Model	Resource Project Based Learning Model	The DICKY's Learning Model based on the Intelligent Tutoring System.
1. Start with the essential question	1. Analysis of Need Assesetement Teacher and Learner	1. Define Problem and Design a plan Project
2. Design a plan for the Project	2. Design and Development of hardware	2. Integrated of Support Sytem
3. Create a schedule	3. Design and Development of Software	3. Creating Project
4. Monitoring	4. Development of system	4. Keep Control and Monitoring
5. Assest the Outcome	5. Project Assistence and Training	5. Yield and Assest Project
6. Evaluate the experience	6. Dissemination project	
	7. Assesment of outcome	

From table 2 above clearly visible syntax comparisons of both the Project-Based Learning model, the Project-Based Learning Model and the DICKY Model based on the Intelligent Tutoring System. The following is the development concept of the previous model so that the DICKY model based on the Intelligent Tutoring System is formed, as shown in the figure below:

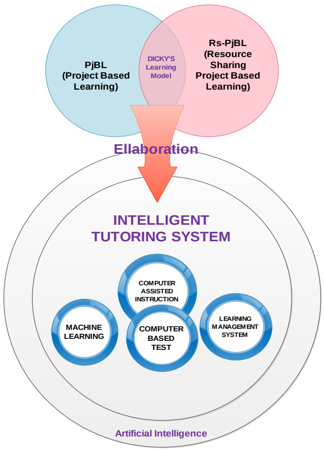

Figure 2. Ellaboration of Learning Model and Learning Media

Figure 2 above also shows the elaboration between the learning model and the learning media. In the media and learning devices, there are several types of machine learning, computer-based tests, learning management systems and computer-assisted instruction that are integrated into a new framework called the intelligent tutoring system. Besides that from the comparative study table above related to the syntax of each learning model, the following is the structure of the development of the DICKY Learning Model based on the Intelligent Tutoring System, as follows: From table 2 above clearly visible syntax comparisons of both the Project-Based Learning model, the Project-Based Learning Model and the DICKY Learning Model based on the Intelligent Tutoring System. The following is the development concept of the previous model so that the DICKY Learning Model based on the Intelligent Tutoring System is formed, as shown in the figure below:

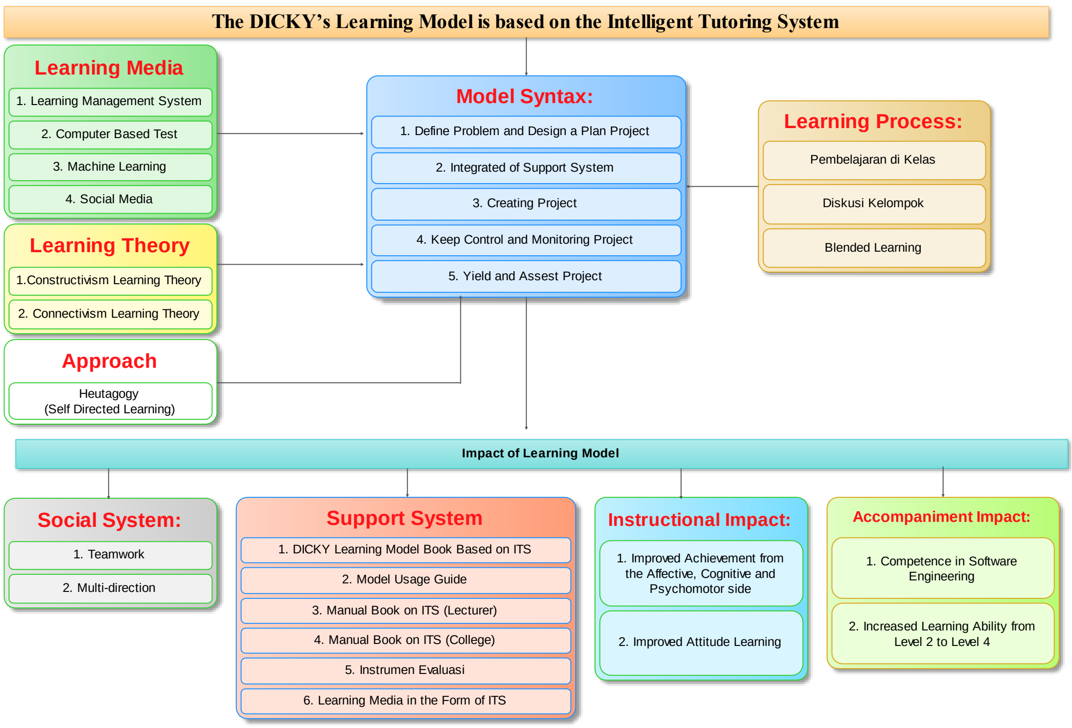

Figure 3. Theoritic of DICKY's Learning Model

Syntax 1: Define the Problem and Design a Plan Project

In phase 1, there are a number of things to do on the concept of this new learning model, namely:

1. Lecturer: Firstly showcases Projects in the IT field specifically related to the design of Intelligent Systems wherein the system there are algorithms, techniques, and methods. Then students are given the task to look for problems that occur around them.
2. Lecturer: Provide information to each student how the mechanism in the learning process of the course

3. Lecturer: Provide information to each student related to the support system used in the learning process especially the Decision Support System courses such as www.Learningmcda.com website page, Facebook group, and youtube channel which have been verified by the lecturer in supporting learning. And students are encouraged to register with the support system to be validated in the course of learning
4. Lecturers and Students: Based on the description of the information above, students are asked to design Project plans either manually or using software such as Microsoft Projects that are based on the objectives of building a System.

Syntax 2: Integrating of Support System

In this second syntax, the pattern of interaction that is carried out is related to the use of ITS (Intelligent Tutoring System) in terms of implementing learning.

1. Students visit this ITS website and then register and download learning materials both from meeting 1 to the final meeting in the form of digital .pdf files and others.
2. Students learn the use of Computer Based Test and Machine Learning as initial understanding at the time of actualization
3. Students register on social media, especially Facebook and Facebook groups that have been designated to be verified by lecturers in the process of chat, discussion forums, teleconferences and others.
4. Students visit the youtube channel to understand the concepts of algorithms, methods or techniques to build an Intelligent System in the form of video data that can be accessed online.

Syntax 3: Creating a Project

In syntax 3, this is to actualize all aspects of the elements of syntax 1 and syntax 2. Because the concept of this learning model is based on ICT, in this case, every student who is designing an Intelligent System must have a basic understanding of ICT, for example, the basis of programming, the basis for designing a good System in modelling, basic system design such as the concept of SDLC or Waterfall Algorithm and basic understanding of the use of devices and technological elements such as the Internet or Smartphone and others.

Syntax 4: Keep Control and Project Monitoring

This syntax is an initial evaluation and stepping stone for enterprise project development in accordance with predetermined Project plans. There are several mechanisms carried out by lecturers and students.

1. Lecturer: conduct initial Testing of Projects that have been designed by students whether done in groups or individually based on previous syntaxes
2. Lecturer: provides input and suggestions for errors both in system design, system modelling, report design, database design that has been done by students.
3. Students: take notes and consider every suggestion and input given by lecturers
4. Students: correct any mistakes made to design then their enterprise devices to be made into a product and the results of an IT Project
5. Students: carry out final testing of software projects that have been improved

Syntax 5: Yield and Assessment of Project

In the syntax of this learning model, there are a number of things done including the student submitting the Project results to the lecturer after a final test is conducted on the previous syntax then the lecturer conducts a final evaluation to provide a final assessment of the results achieved by the student. For more details, it can be seen in the activity table of each learning model syntax below.

3.2 Validation of the DICKY Learning Model Based on Intelligent Tutoring System

After conducting a Focus Group Discussion, a research and data search was conducted to test whether the DICKY learning model based on the Intelligent Tutoring System was made valid or invalid. The validations carried out there are several aspects, namely: (a) validation of the model book, (b) validation of the model use manual, (c) validation of the model manual for lecturers, (d) validation of the model manual for students, and (e) textbook modules and (f) validation of the Intelligent Tutoring System designed. In the validation process, it is carried out by experts in their respective fields including (a) experts in the learning model field, (b) experts in informatics engineering, (c) experts in language, (d) experts in technology and vocational fields and (e) experts in the field research and development. The activities of each expert are validating each research instrument used.

A model that is declared fit or in other words goodness-of-fit models must meet several aspects of assessment, namely: (a) Chi-Square is not significant (or close to zero), (b) The value of The P-Value must be more than 0.05 (> 0.05), (c) the value of the RSMEA (Root Mean Square Error of Approximation) must be less than 0.05 (<0.05) [27]. Then the opinion was reiterated by Meyers. According to Meyers (2013: 870) stated that the model stated fit is influenced by several other factors including (a) the value of Chi-Square divided by degrees of freedom (X2 / df) = if <2 then the model is declared fit and (b) 2 <(X2 / df) <5, the model can be considered fit. In the construct analysis of this study, because the number of samples used was only 5. The sample was not fully used. In addition, based on Mayer (2013: 871) for data whose sample is less than 200, it will cause the value of the RSMEA (Root Mean Square Error of Approximation) to the balloon so that these conditions cannot be used as a reference. So, in this case, the criteria adopted in this study are the values (x2 / df) as stated in Mayer (2013: 871).Validation of the DICKY Learning Model Based on Intelligent Tutoring System.

The following is a picture of the construct validation of Syntax I from the DICKY learning model based on the Intelligent Tutoring System which is seen in Figure 4 to Figure 8 below:

Figure 4. CFA of Syntax I

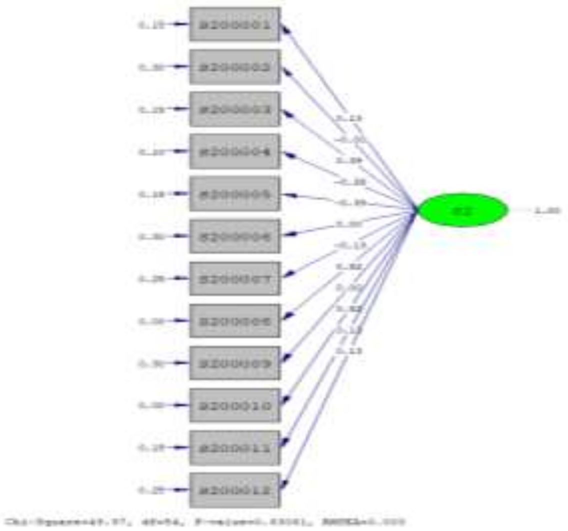

Figure 5. CFA of Syntax II

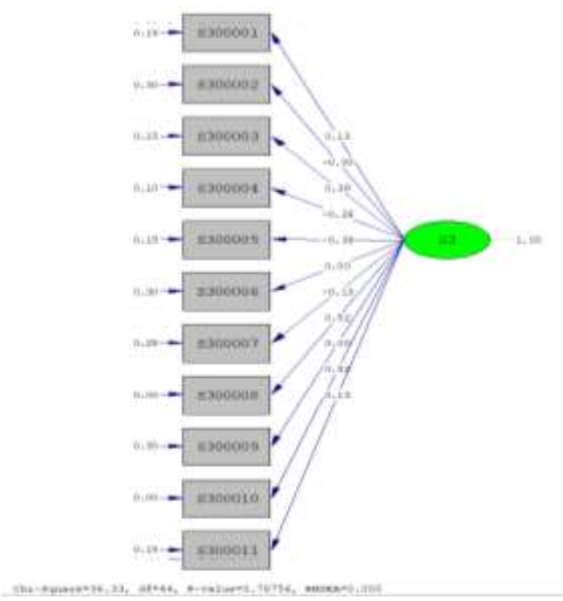

Figure 6. CFA of Syntax III

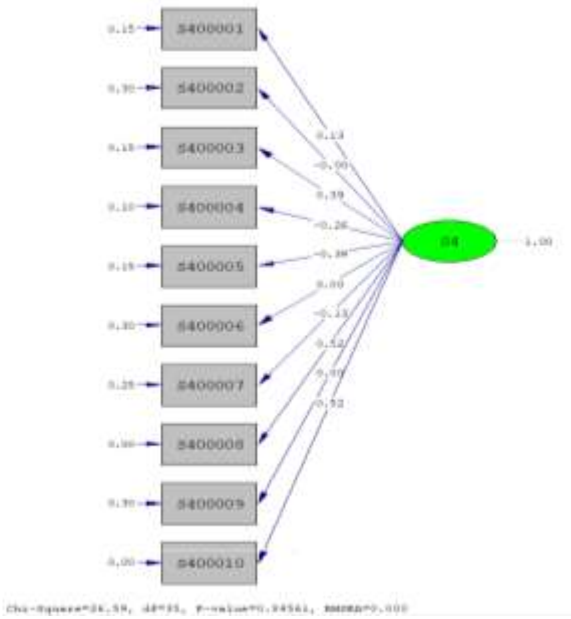

Figure 7. CFA of Syntax IV

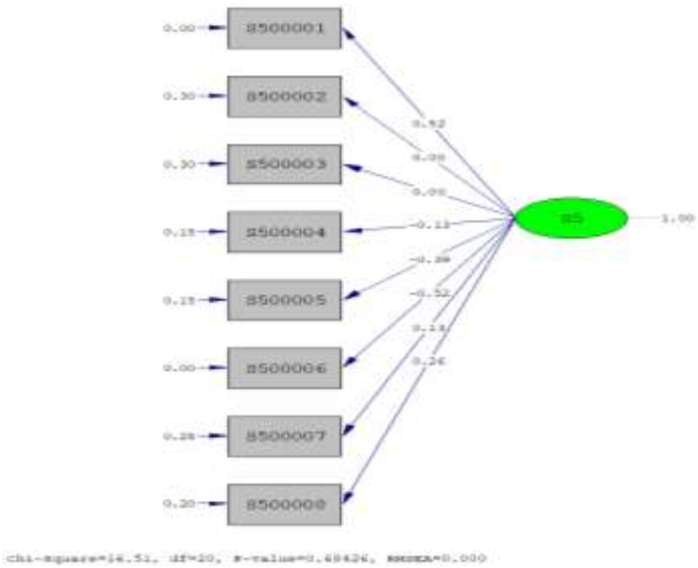

Figure 8. CFA of Syntax V

Figure 4.4 The above states the price of Chi-Square = 35.19 with a P-Value = 0.01913, while the RSMEA value = 0.000 and the value of x2 / df = 1.7595. Based on the analysis of the data above shows that the construct validation of the DICKY learning model based on the Intelligent Tutoring System, in particular, Syntax-I with 8 indicators meets the criteria for goodness-of-fit models, so the construct validity values can be grouped or classified as valid or fit.

3.3 Practicality Test from DICKY Learning Model Based on Intelligent Tutoring System

In measuring the practicality of the DICKY Learning Model Based on Intelligent Tutoring System in terms of various aspects. The aspects of the practicality assessment are as follows: (a) The development process, (b) Ease of Use, and (c) Functionality and Meaningfulness of the model. The following is a summary of the practicality test from the DICKY Learning Model Book Based on Intelligent Tutoring System, namely:

Table 3. Summary of Test Practicality of DICKY Learning Model Based on Intelligent Tutoring System

No	**Evaluator**	**Assessment of Indicator**		
		Indicator I	Indicator II	Indicator III
1	Evaluator I	5	5	5
2	Evaluator II	5	3	4
3	Evaluator III	4	4	4
4	Evaluator IV	4	5	5
5	Evaluator V	5	5	5
Grand Total		24	23	22
Average		4.8	4.6	4.4
Percentage (%)		96%	92%	88%
***Note**		Very practical	Very practical	Very practical

3.4 Efectiveness Test

3.4.1. Limited Effectiveness Test

After measuring and testing the results of the validity of the model and other products, then doing a limited trial of both the pre-test and post-test processes, the step that must be done is to test the effectiveness. Based on the results of data analysis of the limited trial classes conducted in the previous phase, the gain score value can be obtained between pre-test and post-test classes. The following are the results of the analysis of the pre-test and post-test data and the gain score

Table 4. Post-Test Analysis Results From Limited Trial Class Data

Respondents	**Pre-Test**	**Post-Test**	**Gap**	**Respondents**	**Pretest**	**Post**	**Gap**
1	65	70	5	12	50	70	20
2	70	80	10	13	70	80	10
3	55	90	35	14	40	70	30
4	40	90	50	15	50	85	35
5	35	60	25	16	50	85	35
6	60	80	20	17	30	90	60
7	70	80	10	18	40	80	40
8	50	90	40	19	40	95	55
9	40	95	55	20	45	80	35
10	40	85	45	21	50	80	30
11	70	70	0				
Total	1060	1705	645				
Average	50.48	81.19	30.71				
Grand Total	1060	1705	645				

To see a visualization of the difference in the average value of the pre-test and post-test can be seen in the histogram below:

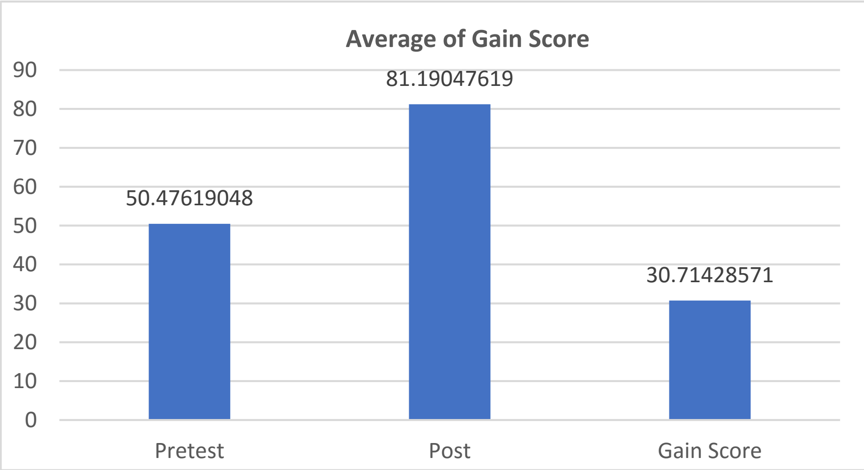

Figure 9. Post-Test Histogram of Limited Trial Class Data

Based on the histogram above can be seen differences in learning outcomes between pre-test and post-test classes of courses in decision support systems. Thus it can be stated and concluded that the treatment or treatment of the DICKY Learning Model that adopts the Intelligent Tutoring System is more effective to improve learning outcomes.

3.4.2. Expanded Effectiveness Test

The extended trial process is a process carried out after the limited trial process is declared effective. The expanded trial was conducted at STMIK Triguna Dharma which took place from August 2018 to September 5 2018. With 32 respondents in the Information Systems study program semester 6. This data will serve as a basis for determining the effectiveness of the DICKY Learning Model based on Intelligent Tutoring System for the Experiment class. Before testing the effectiveness of each experimental class, the pre-test and post-test of the control class are tested first. After conducting the testing phase, both pre-test and post-test on the 2 types of classes both the control class and the experimental class, we get a comparison of the learning outcomes of the two classes. The following is a table of comparison results between the control class and the experimental class based on the pre-test and post-test values, which are as follows.

Table 5. Results of Improvement of Student Learning Outcomes between the Control Class and the Experimental Class

No	**Value**	**Control Class**	**Experimental Class**
1	Pre-test	60,313	61,093
2	Post-test	74,219	79,687
	Gain Score	13,906	18,594

To be able to clearly see the difference from the results of the analysis of the test data above, the following is a histogram of the mean difference between the initial and final values in the control and experimental classes, namely:

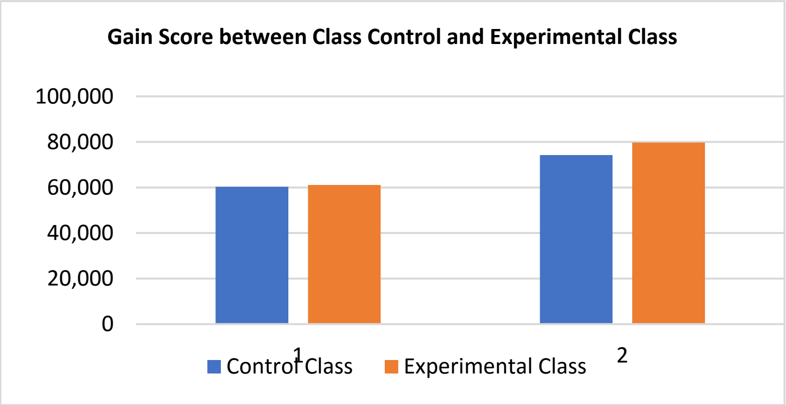

Figure 10. Histogram Improving Student Learning Outcomes between the Control Class and the Experimental Class

Based on the data description presented both in the form of tables and also histograms related to student learning outcomes, it can be stated that the DICKY learning model based on Intelligent Tutoring System is "effective" to improve student learning outcomes, especially in the decision support system courses and is declared very feasible to be a new learning model in digital literacy period in education.

3.5. Test Requirements From Analysis

After testing the effectiveness of both limited and based on the control class and experiment, it takes several more tests, including the normality test and the homogeneity test of the control class and experiment

3.5.1. Normality Test

The normality test process is carried out with several approaches and rules. In this study, the Shapiro Wilk statistical approach was used with a significance level of 0.05. Because according to Lillefors S Correction stated that if the number of samples> 50 then using the Kolmogorov-Smirnov approach while if sample ≤50 uses Shapiro-Wilk. This normality test process is carried out to measure whether the initial or pretest value data for the control class and the experimental class have a normal value distribution so that it can be used in parametric statistics. As explained in the previous description, this normality test is to measure or check whether the data in this study are normally distributed or not. Where a condition is declared normal if the Significance value> 0.05 and vice versa is declared abnormal if the significance value <0.05.

Table 6. Pre-Test Results Improved Student Learning Outcomes

Class		Kolmogorov-Smirnov			Shapiro-Wilk		
		Statistic	Df	Sig.	Statistic	Df	Sig.
Value	Control	.219	32	.200	.835	.32	.463
	Experimental	.228	32	.200	.833	.32	.423

Based on table 4.35 above, several things are known, including the significance value of the results of the normality test results of both Kolmogorov-Smirnov and Shapiro-Wilk. As explained earlier, the normality test used is Shapiro Wilk. Seen above with the Shapiro Wilk approach, the significance value is 0, 463, which means it is greater than 0.05 so that the learning outcomes of the data have a normal distribution.

Table 7. Post-Test Results Improved Student Learning Outcomes

Class		**Kolmogorov-Smirnov**			**Shapiro-Wilk**		
		Statistic	**Df**	**Sig.**	**Statistic**	**Df**	**Sig.**
Value	Control	.222	32	.203	.855	.32	.445
	Experimental	.168	32	.122	.928	.32	.414

3.5.2. Homogeneity Test

Homogeneity testing or testing process of a study is conducted to find out whether some indicators or variances of each data sample or population are declared homogeneous (the same) or not. The following are the homogeneity test results from the Pre-Test values for both the control and experiment classes, as follows:

Table 8. Homogeneity Test of Pretest values in both Control and Experiment classes

Levene Statistic	Df1	Df2	Sig.
2.376	1	62	.128

Table 9. Homogeneity Test of Post-Test values in both Control and Experiment classes

Levene Statistic	Df1	Df2	Sig.
6.280	1	62	.165

Based on the table above, it shows the significant value of the pre-test value both from the control class and the experimental class that is 0.165, which means it is greater than 0.05. Then based on these results, it shows that the variance of the population data is homogeneous and can be used for further testing.

3.5.3 T-Test

The T-Test (Difference Test) from the Pre-Test Results of the Control and Experiment Classes

The different test processes of the pre-test results from both the control class and the experimental class can be seen from the table below which is the result of processing from IBM SPSS software.22 which is as follows:

Table 10. T-Test from Pre-Test Results of Control and Experiment Classes

	Class	N	Mean Rank	Sum of Ranks
Value	Pre-test (Control Class)	32	21.47	687.00
	Pre-test (Experimental Class)	32	43.53	1393.00
	Total	64		
	Mann-Whitney U	159.000		
	Wilcoxon W	687.000		
	Z	-4.910		
	Asymp.Sig. (2-tailed)	.000		

Based on the table above shows the Asymp value. Sig. (2-tailed) i.e. 0 means less than 0.05 (<0.05) then the hypothesis or Ha is "Accepted". This has proven that the initial conditions before the treatment of students in the control class and experimental class, they have almost the same academic ability without any significant difference.

The T-Test (Difference Test) from the Post-Test Results of the Control and Experiment Classes

The different test processes of the pre-test results from both the control class and the experimental class can be seen from the table below which is the result of processing from IBM SPSS software.22 which is as follows:

Table 11. T-Test from Post-Test Results of Control and Experiment Classes

	Class	N	Mean Rank	Sum of Ranks
Value	Pre-test (Control Class)	32	21.47	687.00
	Pre-test (Experimental Class)	32	43.53	1393.00
	Total	64		
	Mann-Whitney U	325.500		
	Wilcoxon W	853.500		
	Z	-2.573		
	Asymp.Sig. (2-tailed)	.010		

Based on the table above shows the Asymp value. Sig. (2-tailed) which is 0.010, meaning less than 0.05 (<0.05) then the hypothesis or Ha is "Accepted". This has proven that the initial conditions before the treatment of students in the control class or experimental class, they have almost the same academic ability without any significant differences.

Analysis of Learning Outcomes From a Psychomotor Perspective

In addition to knowing the learning outcomes in thematic values, the DICKY learning model based on the Intelligent Tutoring System also assessed students from the psychomotor aspects both from the control class and from the experimental class. From the psychomotor aspect, 2 things are measured, namely: (1) Project Software Work Flow and (2) Competency Test Results. Based on the two instruments the following is an explanation

Table 12. Result of Learning Outcome from a Psychomotor Perspective

Respondent	Control	Experimental	Improve	%	Respondent	Control	Experimental	Improve	%
1	77.5	82.5	5	6.061	17	82.5	82.5	0	0.000
2	77.5	82.5	5	6.061	18	77.5	92.5	15	16.216
3	82.5	87.5	5	5.714	19	82.5	90	7.5	8.333
4	80	82.5	2.5	3.030	20	82.5	82.5	0	0.000
5	80	82.5	2.5	3.030	21	82.5	82.5	0	0.000
6	72.5	80	7.5	9.375	22	82.5	87.5	5	5.714
7	72.5	92.5	20	21.622	23	82.5	82.5	0	0.000
8	82.5	85	2.5	2.941	24	77.5	82.5	5	6.061
9	77.5	85	7.5	8.824	25	82.5	85	2.5	2.941
10	77.5	92.5	15	16.216	26	82.5	87.5	5	5.714
11	77.5	82.5	5	6.061	27	82.5	90	7.5	8.333
12	82.5	85	2.5	2.941	28	80	85	5	5.882
13	82.5	92.5	10	10.811	29	82.5	82.5	0	0.000
14	82.5	87.5	5	5.714	30	82.5	90	7.5	8.333
15	77.5	80	2.5	3.125	31	82.5	90	7.5	8.333
16	77.5	82.5	5	6.061	32	77.5	90	12.5	13.889
					Total	2562.5	2745	182.5	207.34
					Average	80.08	85.78	5.70	6.48

Based on the table above shows the results or the average value based on psychomotor values both in the control class with an average value of 80.08 while in the experimental class, the average psychomotor value is 85.78.

Analysis of Learning Outcomes From Affective Perspectives

In analyzing learning outcomes from this affective perspective, it is based on several aspects in accordance with the instruments that have been described in the user manual of the model. In this phase, it will be seen the difference of learning outcomes from the affective domain in the control class and the experimental class. The following is a table of differences in learning outcomes in the affective domain of the control class and the experimental class as follows:

Table 13. Differences in Learning Outcomes in the Affective Domain from the Control Class and in the Experimental Class

No	Assessment Aspects	Control Class	Experimental Class	Affective Score Differences	Percentage (%)
1	Discipline	72.5	84.38	11.88	14.08
2	Commitment	80	82.5	2.5	2.96
3	Responsible	81.25	85	3.75	4.44
4	Communication	76.25	81.25	5	5.93
5	Confidence	79.38	79.38	0	0.00
6	Interest to learn	75	86.25	11.25	13.33
7	Critical	85.63	80	-5.63	-6.67
8	Creative	78.75	80	1.25	1.48
	Total	628.76	658.76	30	

Based on the table above shows the results or the average value based on affective values both in the control class, with an average value of 78.595 while the experimental class psychomotor average value is 82.345. To be able to see a more comprehensive visual, the following is a histogram of the affective average values of the control class and the experimental class of the DICKY Learning Model based on the Intelligent Tutoring System, as follows:

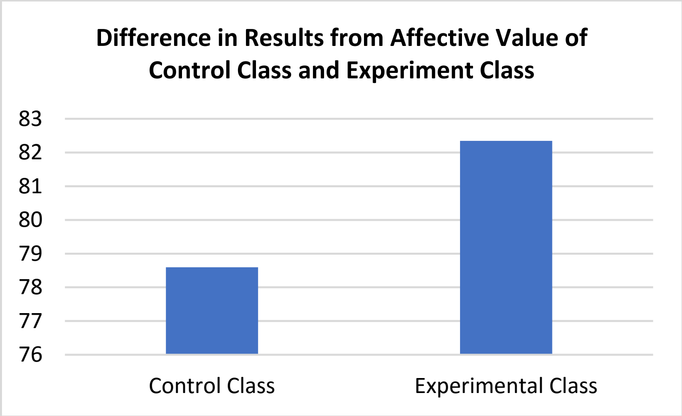

Figure 11. Differences in Learning Outcomes in the Affective Domain from the Control Class and in the Experimental Class

Based on the analysis of the tables and histograms above, it shows that there are differences in learning outcomes in the affective domain between the 2 classes, both the control class and the experimental class. From the histogram above shows an increase in the average results of the control class that is 78, 595 with the experimental class 82.345. However for the critical aspects of the control class is better that is 85.63 while the experimental class is around 80.00. Whereas for the 7 other aspects of effective domain the experimental class is better than the control class. Broadly speaking, the difference in affective scores between the control class and affective class is 3.75 so that it can be concluded that the application of the DICKY learning model based on the Intelligent Tutoring System is more effective in improving student learning outcomes for the affective domain.

3. CONCLUSION

After conducting the research, there are a number of things that can be made as conclusions from this study, namely as follows: (a) Based on the results of research conducted stated that the DICKY learning model based on Intelligent Tutoring System consists of syntax are Define Problem and Design a Project, Integrated of Support System, Creating a Project, Keep Control and Project Monitoring and Yield and Assess of Project. (b) Based on the results of testing the validity of the DICKY Learning Model based on Intelligent Tutoring System, it is declared valid based on several aspects of validity both from the aspect of content validity and the construct that adopts Aiken'V and Confirmatory Factor Analysis. (c) Based on the results of practicality testing of related elements in the DICKY Learning model based on Intelligent Tutoring System which consists of practicality test results is declared "Very Practical". (d) Based on the results of testing the effectiveness associated with the control class and the experimental class, the DICKY learning model based on the Intelligent Tutoring System can be declared effective based on the t-test (limited test)

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